

Design of Automatic Sensor Equipped Shower

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Abstract: The automatic sensor equipped shower is a project that bring many benefits toward the user and environment. The objective of this project is to minimize the time taken for every bath, save the usage of water in daily life by increase its efficiency in every shower taken and avoiding the shower to respond to false signal by adding bluetooth technology. The scope of the project is to include the bluetooth technology into the shower system to increase the efficiency and provide a new way to use shower by optimizing the usage of shower. Method that has been used include simulation in several software and consideration on material for each part of the project is selected based on the engineering properties, cost, market availability and durability. The google form survey has been shared and most respondents seems to agree with the design project and its features. In the future, some improvement can be made in order to suit the outcome of this design project into the market needs.

Keywords: Automatic Sensor, Bluetooth Technology, Bath, Shower

1. Introduction

Performance of the shower system nowadays still can be improved in order to satisfy the specific customer need from different background and personality. The main purpose of this design project is to facilitate people with disabilities to have proper shower session without any assistance from other people.

This trend will also lead to the concept of smart home which are increasingly accepted by the community recently, while open a new door for improvement in the new era of 21st century of technological era [1]. The automatic sensor equipped shower was intended to reduce the time taken in every bath, save the usage of water in daily life by increase its efficiency for every shower taken. This new design system is able to prevent the shower to respond to false signal by adding bluetooth technology in the shower system [2]. The existing sensor system is very sensitive and responding to any moving things that comes to an appropriate close proximity [3, 4, 5]. This phenomenon is caused by a false signal. Unusual light reflected toward the infrared area is one kind of this false signal. The false signal is the major contributing factor to the ineffective operation of the sensor system [6]. The objective of this design project is to improve the performance of the shower by introduction of additional system by using bluetooth technology. This new control system is done through smartphones with Bluetooth technology. The outcome of this upgraded shower control system is able to provide new way for people to use the shower and optimize the usage of shower system [7].

2. Materials and Methods

Several discussion sessions had been conducted in order to proceed this project to the next level. One of the topics were material and method to be used to make this design project a success. Some materials were rejected in the first place because of the features are not tailored with the requirement of the project. To conclude the process of material selection, four types material are recognized and suitable for this project. In addition, several methods need to be detailed to make sure the system is accepted successfully.

2.1 Materials

The material for each part of the project is selected based on the engineering properties, cost, market availability, and durability. The selected materials in the development process of the automatic sensor equipped shower prototype are [8-9]:

- i. Zink Alloy
- ii. Solid Brass
- iii. Plastic
- iv. Stainless Steel

This material may be replaced with a more reliable materials according to market needs in the future. The durability, strength, stress and strain limit of these materials are the main concerned to make it suitable to be selected in this design project.

2.2 Methods

The approach in this design project involved simulation method to produce the virtual prototype. This involve the Solidwork and Tinkercad software. So, a detail investigation on the software is needed to make it workable. Two set of google form survey also has been carried out to support this research process to acquire suggestion and recommendation from the community.

2.3 Coding system

This design project required the Arduino system by programming the Arduino to always output high on pins 10, 11 and 12 unless a signal is received which will toggle the pin too low for half a second. This effectively mimics the pressing of the switch. The Arduino code is stated as:

```

#include <SoftwareSerial.h>
char receivedChar;
int powerPin = 12; // power pin
int tempUpPin = 11; // to increase temperature
int tempDownPin = 10; // to decrease temperature
SoftwareSerial mySerial(0, 1); // bluetooth serial RX,TX
void setup()
{
  // Set pins as output
  pinMode(powerPin, OUTPUT);
  pinMode(tempUpPin, OUTPUT);
  pinMode(tempDownPin, OUTPUT);
  // Set pins as high initially (active low logic)
  digitalWrite(powerPin, HIGH);
  digitalWrite(tempUpPin, HIGH);
  digitalWrite(tempDownPin, HIGH);
  // Open serial communications and wait for port to open
  mySerial.begin(9600);
  mySerial.println("Sending a '1' will turn toggle shower on/off");
  delay(1000);
  mySerial.println("Sending a '2' will increase temperature");
  delay(1000);
  mySerial.println("Sending a '3' will decrease temperature");
}
void loop()
{
  while (!mySerial.available()); // Wait for COM port to open
  receivedChar = mySerial.read();
  if (receivedChar == '1') {
    digitalWrite(powerPin, LOW);
    delay(50);
    digitalWrite(powerPin, HIGH);
  } // Toggle power pin to simulate button press
  if (receivedChar == '2') {

```

```

digitalWrite(tempUpPin, LOW);
delay(50);
digitalWrite(tempUpPin, HIGH);
} // Toggle temp up pin
if (receivedChar == '3') {
digitalWrite(tempDownPin, LOW);
delay(50);
digitalWrite(tempDownPin, HIGH);
} // Toggle temp down pin
}
Sending a '1' will turn toggle shower on/off
Sending a '2' will increase temperature
Sending a '3' will decrease temperature

```

The 9 volt battery is used in the control circuit to replace the power source for the time being as the project simulation require a power source.

3. Result and Discussions

The main goal of this research is to determine the importance of shower usage in the domestic household. The data and information gathering of the automatic sensor equipped shower is through the design for this project and recorded all the simulation data results. Google form survey also is introduced to several respondents to acquire their opinion and thought about this design project and the future improvement to be considered in ensure the product of this design project is competitive in the market.

3.1 Results

The result in this design project is the compilation of information and suggestion from the google form survey and testing conducted from the simulation in Solidwork and Tinkercad software. The list of components, google form survey result, the stress and strain simulation test results and also the circuit that has been created for this project along with the schematic diagram. **Table 1** shows all the required components to establish the installation of this design project.

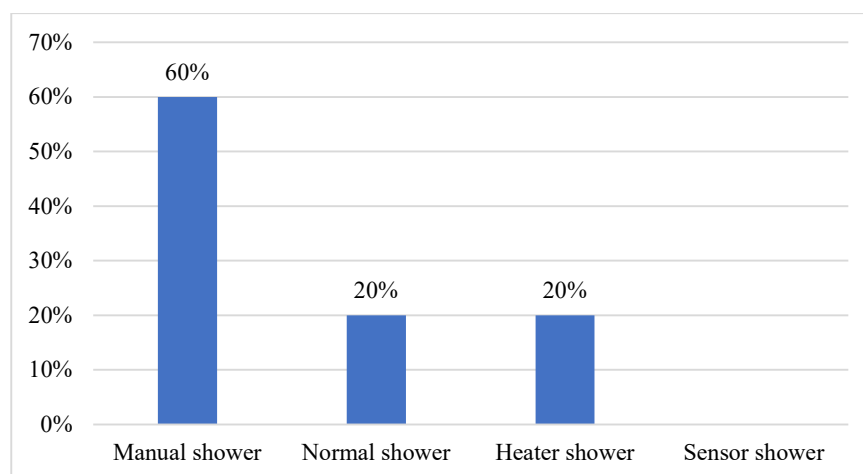
Table 1: List of components used for this project

No.	Components	Quantity	Cost by unit (RM)
1	Shower head	1	42.00
2	Shower control panel	1	154.00
3	Infrared sensor eye	1	7.00
4	Flexible hose	1	16.00
5	Sensor signal wire	1	17.00
6	Control box	1	23.00
7	Direct current motor (DC)	1	28.00
8	Transformer	1	13.00
9	ESP 32	1	37.00
10	Solderless board	1	8.00
11	Resistor 100 Ohm	1	5.00
12	Resistor 220 Ohm	1	5.00
13	Resistor 1000 Ohm	1	5.00
14	Wires (red)	1	7.00
15	Wires (black)	1	7.00
Total			374.00

Table 1 shows the cost of all components for the complete assembly of the automatic sensor equipped shower in this project. All information is acquired from Shopee and Lazada, the online shopping platforms. The items were the most affordable from their categories in order to ensure the cost of the complete assembly of the automatic sensor equipped shower is kept at the lowest value.

3.2 Google Form Survey and Project Design

Figure 1 shows the google form survey around 60% of the respondents were using normal showers followed by manual showers and heater showers at 20% and none of the respondents seems to be using sensor showers at their home. Meanwhile **Figure 2** shows that the main choice of respondents is shower an affordable price. The next selection is not raised in monthly water bill and followed by the choice that they are not sure where to buy their desired shower. The survey also highlighted that only several respondents seem not aware of the existence of another type of showers in the market.

**Figure 1: Type of shower used in the respondent house**

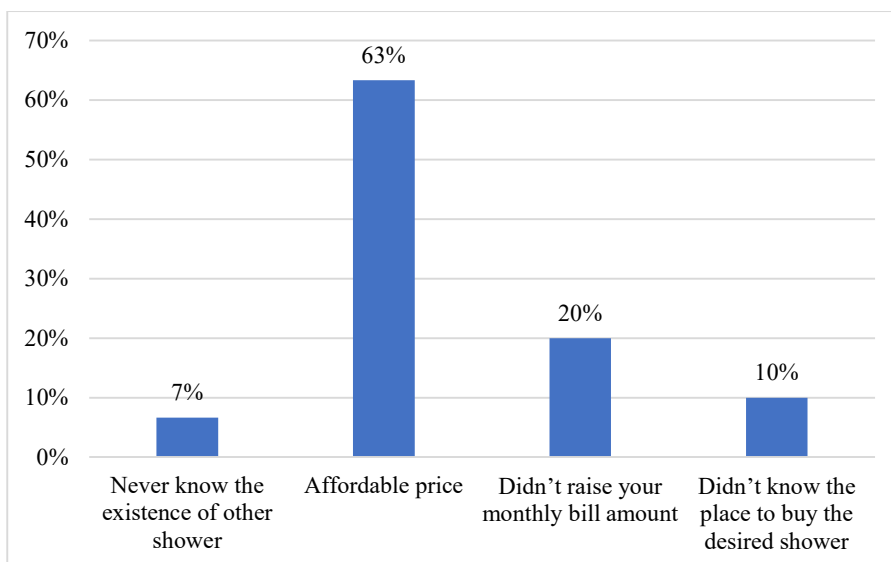


Figure 2: Respondents reason for the use of their current shower

Further studies are continued through **Figure 3** shows the analysis about the respondents' experience on using the hot shower. Based on the analysis made by the google form survey, around 64.5% (20 respondents) of the respondents have experienced using the hot shower in their life. While around 35.5% (11 respondents) of the respondents never had the experience of using nor handling the hot shower. From the analysis as shown in **Figure 4**, around 66.7% of respondents agreed that the most common problem of their shower system is the water released by the shower head is quite slow. Meanwhile 6.6% of them experiencing difficulties with failure of shower system. It is found that 16.7% of the respondents satisfied with their shower system, while around 10% of them facing problem with clogged shower head.

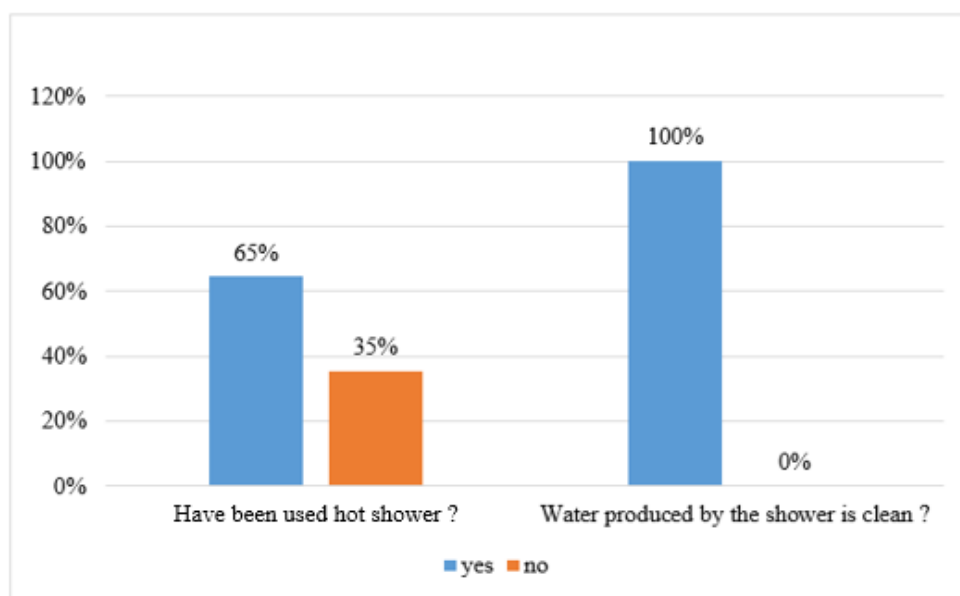


Figure 3: Respondents respond for their shower problem

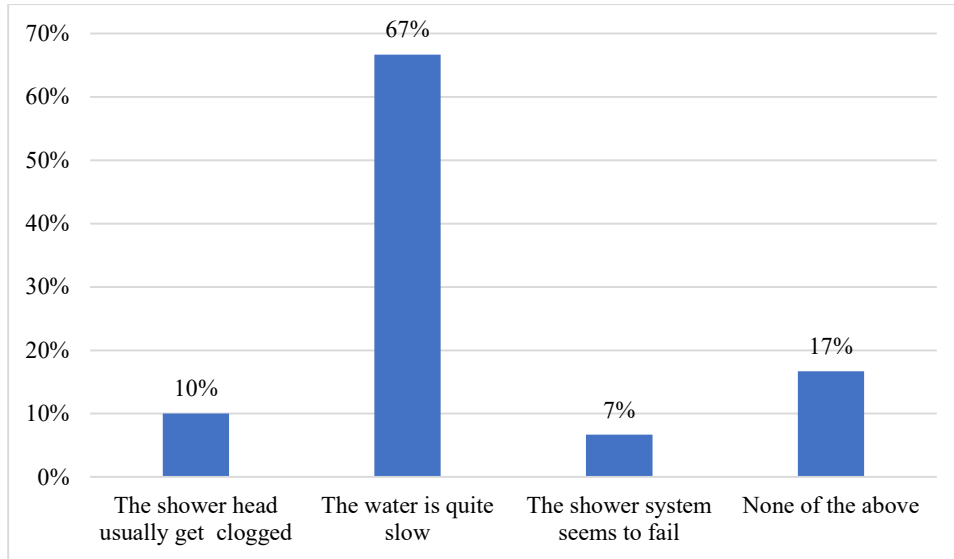


Figure 4: Most common problem cause by shower according to respondents

3.3 Design and Simulation

Figure 5 shows the outcome of the simulation of automatic sensor equipped shower from the solidwork software. The strength of the selected design is tested using solidwork software as well to make sure the automatic sensor equipped shower is reliable to be used. It is called the stress and strain simulation. This simulation will determine the magnitude of stress and strain developed in the design. Thus, the best solution is to use the tinkercad software as it allows researchers to build a virtual circuit with the complete simulation. After several runs, the research team members managed to finalize the circuit for this project. The motor in the circuit is used to control the valve to permit flow of water. The battery is used to resemble the power source for the circuit and the arduino is the medium for the system to operate. The circuit diagram for automatic sensor equipped shower in this design project is shown in **Figure 6**.

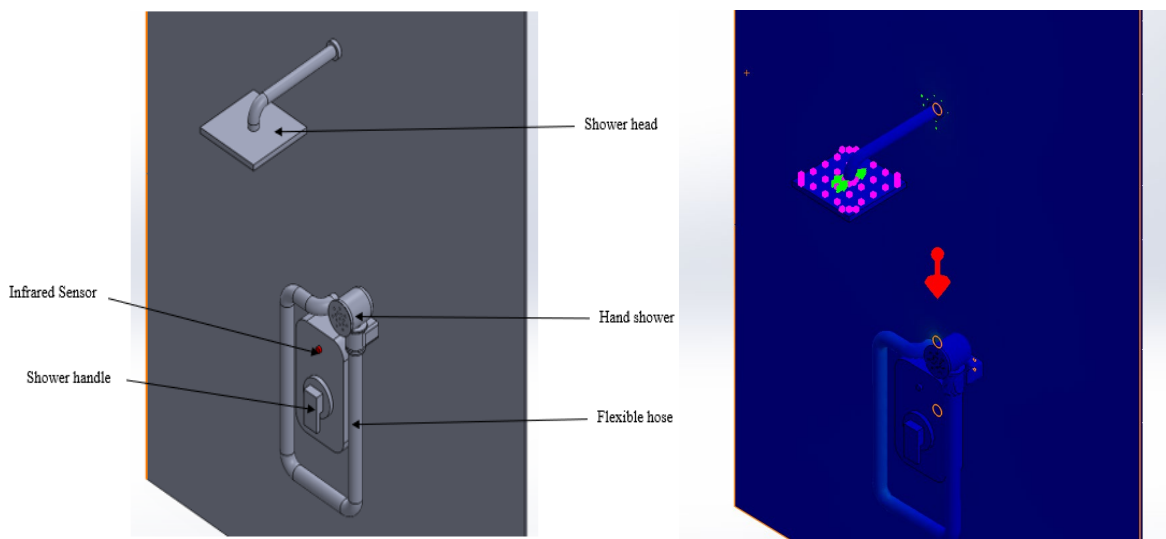


Figure 5: Isometric view of the main components part of sensor shower design and simulation

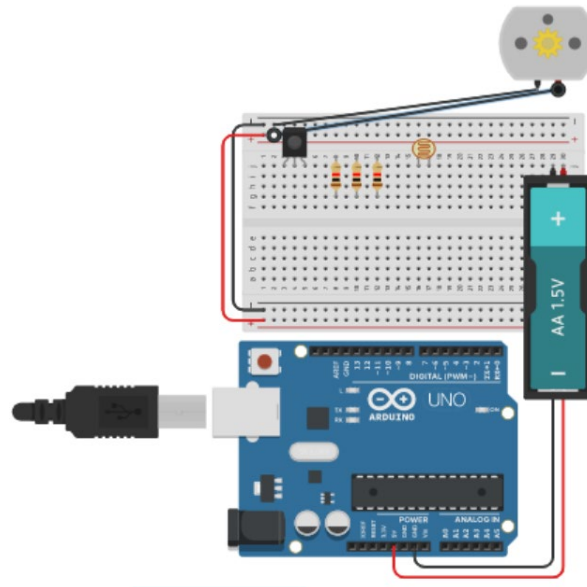


Figure 6: The Arduino concept is used in the automatic sensor equipped shower

Comparatively through a questionnaire study of the shower design as shown in **Figure 7**, it is found that 67.7% of the respondents expected that the newly designed automatic sensor equipped shower is user friendly. About 25.8% of the respondents seem to be just satisfied with the shower user friendliness. While another 3.3% of the respondents seem to disagree with the statement and another 3.2% of the respondents very disagree with the statement.

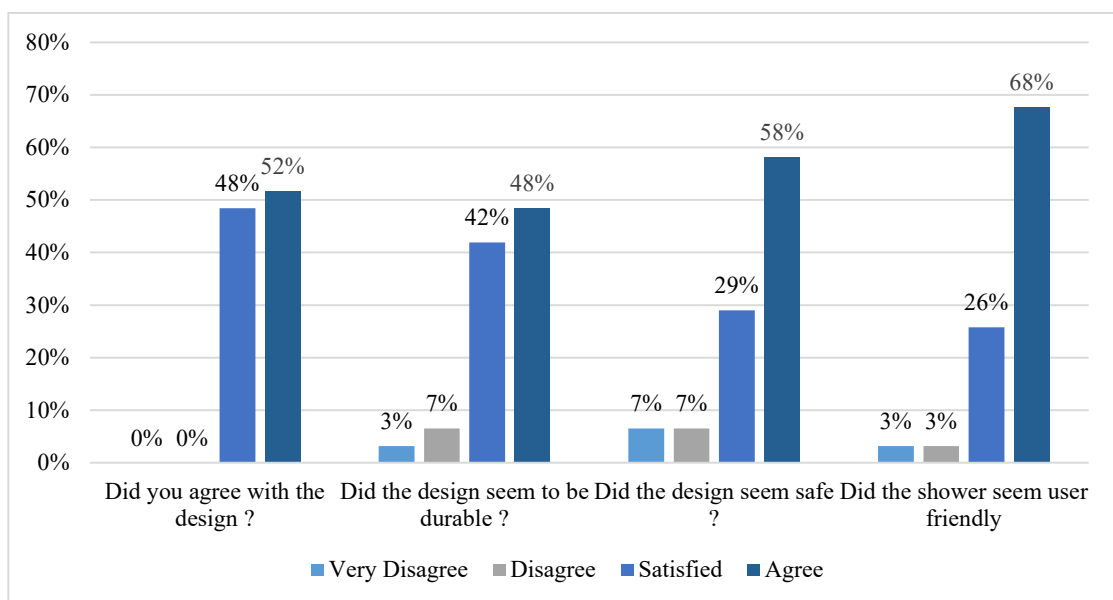


Figure 7: Respondents react toward the shower design

3.4 Discussion

The data collected from the research has been discussed and concluded. The data is gained through simulation process from the Solidwork and Tinkercad software. The selected shower design has passed the simulation stress test. Therefore, the design process is carried out to complete the whole project. The data has been produced from the simulation by the Tinkercad and Solidwork software has been analyzed with further detail to satisfy the research objective. The circuit also has passed the test and the simulation runs smoothly. In order to strengthen the outcome of the research, two sets of survey had been conducted to include a wide variety of people. The data has been gained then be categorized and analyzed. Figure 7 shows the analysis research data processes from the google survey. The analysis for the shower also included the efficiency of the shower and the reaction time. In the method that has been used, the type of shower used in the sensor with bluetooth technology and the simulation will be carried at least three times in a set of three set of tests. This process is needed to reach the most accurate reading of the system and the efficiency of the project.

4. Conclusion

This project is one of the recent trends of smart home projects where users are able to control many systems from their smartphones. This design project is highly benefited by disable people who are able to have their proper shower without any assistance. This design project is able to minimize water losses due to false or erroneous signal. According to the test results, the efficiency of shower is being considered according to the reaction time and the rate of water released in a minute. This also indicate the shower is more sustainable and durable as it does not required too much direct human contact.

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